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Research Article

Project guidance self-efficacy scale: Validity and reliability study

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Abstract: Self-Efficacy scale for teachers. The items of the scale were prepared as a result of examining the literature on self-efficacy and project-making. In the first stage, the scale, which contains 40 items, was applied to a total of 578 teachers working in different branches in 7 geographical regions of Türkiye. The collected data were used to perform exploratory factor analysis (N=199) and confirmatory factor analysis (N=379). As a result of the exploratory factor analysis, it was determined that the scale, which was reduced to 19 items, had a 3-factor structure (project topic selection guidance, project implementation guidance, and project reporting guidance). The confirmatory factor analysis showed a good fit of the 19-item three-factor structure. The results revealed Cronbach's Alpha coefficient (α=.96) and McDonald's Omega (ω=.96) in the exploratory factor analysis data set, indicating a good internal consistency for the overall scale; and Cronbach's Alpha coefficient (α=.95.) and McDonald's Omega (ω=.95) in the confirmatory factor analysis data set, reflecting an excellent internal consistency. The results of the study show that the developed project guidance self-efficacy scale has good psychometric properties and reliability to measure teachers' self-efficacy for project guidance.

1. INTRODUCTION

The methods of accessing, processing and sharing information, which have changed dramatically in recent years, have further affected the ways we communicate and connect with each other. In order to participate in a world of rapidly expanding global networks and changing economic challenges, and to have the human skills/competencies needed, school curricula also need to be carefully developed. Advocates of 21st-century learning argue that schools have a responsibility to provide students with the opportunity to be intellectually creative, innovative, collaborative and often to think beyond boundaries (Bernhardt, 2015). Likewise, UNESCO points out that a student-centered learning approach should be adopted in education instead of solely teacher-lectured content (International Commission on the Futures of Education, 2021). These developments in perspectives have led to the prominence of student-centered approaches.

Student-centered approaches often positively affect students' knowledge and skills in various fields (Chen & Yang, 2019; Iwamoto *et al*., 2016). Kokotsaki *et al*. (2016) argued that Project-Based Learning (PBL), which is one of the course delivery methods that ensures active

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participation of students and improves their interaction and communication, stands out among all student-centered pedagogical approaches. PBL, which is an inquiry-based learning style that provides a meaningful learning experience along with a learning context with questions or problems involving real-world applications, is characterized as a teaching style that supports active and autonomous students, enables them to do creative research, set goals, collaborate, communicate and experience real-world applications (Kokotsaki *et al*., 2016).

In recent years, it has gained importance in curricula to provide students with the competence to develop project production skills and to use these skills effectively. In our country, organizations such as MoNE, Development Agency, European Union, and TUBITAK prepare local, national and international projects, and organize competitions and regional exhibitions in order to encourage students to work in basic, social and applied science fields, to guide their studies and to contribute to the development of their existing scientific studies. Especially in projects where global and social problems come to the forefront, students are expected to offer solutions by focusing on real-life problems. In the project development process, the competence of the project advisor constitutes one of the main components in terms of the quality of the project. Therefore, it has become critical to understand teachers' perceived self-efficacy in guiding student projects. Teachers' PBL guidance self-efficacy is an important construct that has not yet been sufficiently studied in education. In order to develop a comprehensive understanding of teachers' PBL guidance self-efficacy, teacher beliefs in this area need to be measured.

Although PBL is increasingly emphasized in contemporary school curricula, measurement tools that provide information about teacher self-efficacy are still limited. When the self-efficacy scales developed for PBL in the literature were examined, only two studies were found (Mutlu & Yıldız Fidan, 2018; Yaşar & Oral, 2024); in these studies, it was determined that the scale items did not reflect self-efficacy beliefs in a way to express overcoming a challenge.

Given the limitations of the existing scale, the purpose of this study is to develop a valid and reliable scale that measures teachers' self-efficacy for guiding project-based instruction. Such a scale could be valuable in helping all teachers worldwide assess their self-efficacy in guiding PBL, thus facilitating and enhancing the effectiveness of teachers' preparation and professional development programs.

1.1. Project Based Learning

Project-based learning (PBL) is a method of learning that encourages students to participate in authentic activities and deal with real-world problems like professionals (Kokotsaki *et al*., 2016). Specifically, it allows students to learn by asking questions, discussing ideas, designing plans, communicating with others and seeking solutions (Choi *et al*., 2019). Beginning the project with a leading question, exploring the leading question by engaging in authentic and situational inquiry as part of a collaborative activity, learning experience supported by teachers, addressing the learning objectives and a series of products or artifacts created by the students to answer the original question are referred to as the common features of the PBL approach (Krajcik & Blumenfeld, 2006). PBL is an approach that supports active participation, independent learning (Condliffe *et al*., 2017) and collaboration (Condliffe *et al*., 2017, Chu *et al*., 2017) in the learning process. PBL is also reported to be enabling the student to deepen and integrate knowledge (Iwamoto *et al*., 2016, Maros *et al*., 2023). PBL teaches students to apply knowledge to the real-world cases and to use it to solve problems, answer complex questions, and create high-quality products (Larmer & Mergendoller, 2015). PBL is an effective method for developing 21st-century skills such as critical thinking, problem solving, communication (Chu *et al*., 2017) and creativity (Duchovicova *et al*., 2018). It is also stated that PBL positively affects students' learning motivation (Chiang & Lee, 2016; Mahasneh & Alwan, 2018).

Despite the benefits of PBL, teachers in Türkiye prioritise traditional assessment tools (Gelbal & Kelecioğlu, 2007; Önel *et al*., 2020; Türkben, 2022) and teacher-centred teaching practices

(Çoban *et al*., 2021; Şahin & Ulucan, 2023; Yaylak, 2020). As the new Turkish Curriculum Guidelines aim to trigger a shift from a teacher-focused pedagogy to a student-focused pedagogy, improving teacher qualifications and, in this context, determining the relevant self-efficacy of teachers regarding teaching with PBL is significant for future policy interventions and studies on the development of teacher beliefs.

1.2. Measuring Project-Based Learning and Teacher Self-Efficacy

Bandura (1977, 1994) defined self-efficacy as an individual's belief in his or her capacity to execute behaviors necessary to produce specific performance attainments. It is known that self-efficacy belief is necessary to perform a certain behavior (Bandura 1977, 1994). Bandura (1977) states that self-efficacy plays an important role in how one approaches goals, tasks and challenges. It is reported that individuals with high self-efficacy beliefs tend to remain resilient when faced with difficulties, set high goals for themselves, spend more effort on their goals, and are strongly attached to their goals (Bandura, 2012). Bandura (1997) states that individuals with low self-efficacy beliefs exhibit behaviours such as not being able to do a job voluntarily, giving up quickly and often limiting their options because they doubt that they will be successful. In addition, individuals with high self-efficacy attribute their failures to correctable situations such as lack of effort and inappropriate strategies, while those with low self-efficacy attribute their failures to a lack of ability.

Self-efficacy is related to a certain field. In other words, individuals with high self-efficacy beliefs in one field may have low self-efficacy beliefs in another field (Cassidy & Eachus, 2002). Individuals develop self-efficacy with information collected from four sources: Mastery Experiences (Performance Outcomes), vicarious experiences, verbal persuasion and physiological feedback. According to Pajares (1997), self-efficacy mostly emerges in relation to specific areas or specific tasks. It would not be wrong to mention that one of the most important of these specific areas is teacher self-efficacy. Teacher self-efficacy, which is considered for long as one of the most important factors in teachers' functioning, is defined as teachers' judgment of their ability to effectively organize and execute specific courses of action (Skaalvik & Skaalvik, 2010).

Although PBL is emphasised more in contemporary school curricula, it was determined that the measurement tools that provide information about teacher self-efficacy related to PBL guidance are limited. As a result of the literature review, only two scale development studies on teachers' PBL guidance self-efficacy were found. In the study conducted by Mutlu and Yıldız Fidan (2018), a project-based teaching self-efficacy scale was developed for science and classroom teachers and applied to only 256 science and classroom teachers. The scale, which was found to include different dimensions, was applied to a limited number and disciplines of teachers and only exploratory factor analysis was used for analysis. It was determined that many sub-dimensions related to project guidance were found together in the scale and addressed with a limited number of items. When the scale developed by Yaşar and Oral (2024) is examined, it is noteworthy that the items do not reflect the self-efficacy structure to overcome a difficulty or challenge. In summary, the inadequacy of the studies in the literature to develop a valid and reliable measurement tool for teacher self-efficacy related to PBL necessitated the development of a new scale on this subject.

This study aims to develop a valid and reliable scale that measures teachers' project guidance self-efficacy.

2. METHOD

2.1. Study Design

This is a general survey and screening study conducted with the aim of developing a scale. As the data are collected from a wide population, it is possible to generalize the research results (Fraenkel *et al.*, 2012).

2.2. Study Group

In the study, teachers working in all public (primary, middle and high school) schools in seven regions of Türkiye were randomly selected and a total of 578 people who agreed to participate in the study were included in the sample. Teachers from every province and every school level were included to increase the widespread impact of the study. Two separate study groups were used for the purpose of this research. The first group, from which exploratory factor analysis (EFA) data were collected, consisted of 199 individuals 56.3% of whom were women and 43.7% were men; the second group, from which confirmatory factor analysis (CFA) data were collected, consisted of 379 individuals 58.3% of whom were women and 41.7% of whom were men (Table 1). Disciplines concerning the participants included in the exploratory and confirmatory factor analysis and the teachers whose project guidance self-efficacy were examined are exhibited in Table 1. Accordingly, the participants in the first study group from which EFA data were collected consisted of 199 individuals, 46.2% of whom were Science-Mathematics teachers, 46.7% were social sciences teachers and 11.1% were sports-art-language teachers; the second group from which CFA data were collected consisted of 379 individuals, 46.7% of whom were Science-Mathematics teachers, 38.3% were social sciences teachers and 15.0% of whom were sports-art-language teachers (Table 1).

Table 1. *Distributions of three participant groups by gender and disciplines.*

		EFA	CFA
Qualifications		*f* (%)	*f* (%)
Gender	Male	87 (43.7)	158 (41.7)
	Female	112 (56.3)	221 (58.3)
Discipline	Science-Mathematics	92 (46.2)	177 (46.7)
	Social Sciences	85 (42.7)	145 (38.3)
	Sports-Art-Language	22 (11.1)	57 (15.0)
	Total	199 (100)	379 (100)

2.3. Data Analysis

In order to determine whether the data obtained from the developed scale meets the requirements of factor analysis, the normality of the distribution and extreme values were examined. In addition, before the analyses, missing data were examined with Little's MCAR (Missing Completely at Random) test. However, since there were no missing values in the data set, the estimated means value could not be calculated. The data set was divided into two parts and EFA and CFA analyses were performed. Exploratory factor analysis (EFA) was performed to reveal the status of the data structure and reduce the factor whereas confirmatory factor analysis was performed to test the resulting structure. EFA was performed using Promax rotation for the construct validity of the measurements. Since it is a widely used method in the field of Social Sciences, the Principal Component was used as the factor extraction method in this study (Açıksöz *et al*., 2024). The suitability of these data for EFA was evaluated with the Kaiser criterion and Bartlett's Sphericity Test. In addition, in determining the number of factors, the eigenvalues greater than 1 were taken into account and their compatibility with the prepared draft scale was checked. In addition, the scree plot was checked. The item-total statistics of the measurement tool were examined. The averages of the scores in the lower and upper 27% groups of the total scores obtained from the scale were compared with the *t*-test.

The internal consistency of the measurement tool in reliability analyses was calculated using Cronbach's Alpha (α) and McDonald's Omega (ω) coefficients. CFA fit indices were compared with excellent and acceptable values reported in the literature. In CFA, the perfect fit of the measurement models to the data (CFI=.99; SRMR=.03; NFI=.98; NNFI=.98; IFI=.99) and acceptable fit (RMSEA=.04; PNFI=.86) were evaluated as evidence of construct validity

(Schermelleh-Engel *et al*., 2003). IBM SPSS Statistics 15 and JASP programs were used in the study.

2.4. The Steps of Scale Development

This study was designed in accordance with the scale development process (item generation, questionnaire administration, item reduction and CFA) proposed by Wang (2003). In the preparation phase of the developed Project Guidance Self-Efficacy Scale, the literature related to self-efficacy, project making and project process (Schwarzer & Jerusalem, 1995; Schmitz & Schwarzer, 2000; Mutlu & Yıldız Fidan, 2018) was examined. After the examinations, a total of 40 items were prepared within the scope of project preparation (13 items), project implementation (13 items) and project reporting dimensions (14 items). The scale was examined for content validity by three field educators, two measurement and evaluation experts, and a Turkish language expert. Content validity is the primary validity analysis that provides information about whether a scale measures the desired feature (Cronbach, 1970). In line with the expert opinions, the finalized draft scale included 40 items. In the scale, the participants were asked to give graded responses as “Totally Agree (5), Mostly Agree (4), Somewhat Agree (3), Somewhat Agree (2), Strongly Disagree (1)”. An online survey was conducted to collect scale development data. The questionnaire was created on Google Forms and the link was sent to the teachers. Afterwards, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted to reveal the construct validity of the scale

In order to reduce bias in the data collection process, attention was paid to having fewer items in the scale. In addition, care was taken to keep the items short so that the scale could be answered in a short time. In addition, care was taken to use correct and clear expressions so that the scale items only tested one behavior and could be understood in the same way by each reader. Finally, negative statements were added to the scale and underlined to draw the reader's attention. Afterwards, expert opinion was obtained, and a pilot study was conducted. Before the expert opinion, the scale included 14 items in each of the three dimensions (project preparation, project implementation and project reporting dimensions). In line with the opinions of the experts, one item was removed from each of the project preparation and project implementation dimensions because the items covered each other. The validity, comprehensibility and expression problems of the items in the scale were not detected. A pilot study was conducted with 17 teachers from different branches and no changes were made after the pilot study. As a result of the pilot study, no negative situation was detected regarding the comprehensibility of the questions and their effect on the participants. No ethical problems were encountered during the data collection process. In addition, the time required to complete the study was sufficient for teachers to answer the questions without getting bored.

3. FINDINGS

3.1. Findings Regarding Exploratory Factor Analysis

The appropriateness of the dataset for factor analysis was confirmed with the Kaiser Meyer Olkin (KMO) value and Bartlett's Test of Sphericity. The analysis indicated that the KMO value was .951 and the result of Bartlett's Test of Sphericity was significant. (χ^2 = 3439.075; p=.000).

The principal components extraction method was used to determine the construct validity of the scale and to size the items by determining their factor loadings. Items loaded on more than one factor were removed from the analysis (m6, m7, m8, m9, m10, m11, m12, m13, m23, m24, m25, m26, m27, m33, m34, m35, m36, m37, m38, m39, m40). The remaining items were grouped under three factors (guidance for choosing the project topic, guidance for project implementation, and guidance for project reporting). The total Variance Explained by the Scale was calculated at 69.208%. Eigenvalues and the variance explained by each factor are presented in Table 2.

Table 2. *Eigenvalues for the scale and explained variances.*

Factor	Eigenvalue	Variance %	Total Variance %
1. Guidance for Project Implementation Self-efficacy	11.516	60.608	60.608
2. Guidance for Project Reporting Self-efficacy	1.420	7.475	68.083
3. Guidance for Choosing the Project Topic Self-efficacy	1.085	5.711	73.794

Three factors created in line with the meanings of the items were named Guidance for Choosing the Project Topic Self-efficacy (Factor 3), Guidance for Project Implementation Self-efficacy (Factor 1) and Guidance for Project Reporting Self-efficacy (Factor 2). Promax rotation was preferred for the factors revealed by the Principal components method. Items collected under three factors are in Table 2 and their common variances are presented in Table 3.

Table 3. *Factor loadings.*

		Post Rotation		
Item No	Common Factor Variance	Choosing the Project Topic (Factor 3)	Project Implementation (Factor 1)	Project Reporting (Factor 2)
M1	.642	.888		
M2	.703	.713		
M3	.792	.878		
M4	.782	.890		
M5	.699	.628		
M14	.666		.820	
M15	.571		.608	
M16	.761		.905	
M17	.685		.874	
M18	.720		.888	
M19	.690		.706	
M20	.722		.666	
M21	.761		.781	
M22	.698		.733	
M28	.797			.738
M29	.825			.711
M30	.867			.987
M31	.883			.917
M32	.755			.819

Table 3 reveals that there are 5 items under the Guidance on Choosing the Project Topic factor. There are 9 items under the Guidance on Project Implementation factor and 5 items under the Guidance on Project Reporting factor. Inter-factor correlation values are given in Table 4.

Table 4. *Inter-factor correlation values.*

Factors	*r*
Guidance for Choosing the Project Topic Self-efficacy-Guidance for Project Implementation Self-efficacy	.70*
Guidance for Choosing the Project Topic Self-efficacy-Guidance for Project Reporting Self-efficacy	.72*
Guidance for Project Implementation Self-efficacy - Guidance for Project Reporting Self-efficacy	.77*

p<.01

3.2. Results Regarding the Reliability of the Scale

In order to determine the item discrimination levels, the item discrimination of the upper and lower groups of 27% was analysed. For this purpose; internal consistency of the total scale and sub-dimensions, in other words, Cronbach's Alpha, Stratified Alpha and McDonald's Omega values, which determine how closely the items are related to each other were analysed. The results concerning the reliability of the scale are presented in Table 5.

Table 5. *Results concerning the reliability of the scale.*

Factor	Item No	*t* Lower %27-Upper %27 (*n*=54)	Cronbach's Alpha (α)	McDonald's Omega (ω)
Guidance for Choosing the Project Topic Self-efficacy	M1	-9.452*	.900	.902
	M2	-10.359*		
	M3	-10.663*		
	M4	-10.474*		
	M5	-11.142*		
Guidance for Project Implementation Self-efficacy	M14	-10.167*	.941	.941
	M15	-10.551*		
	M16	-12.983*		
	M17	-12.226*		
	M18	-11.065*		
	M19	-11.088		
	M20	-10.628*		
	M21	-11.517*		
	M22	-11.298*		
Guidance for Project Reporting Self-efficacy	M28	-11.837*	.943	.943
	M29	-13.715*		
	M30	-11.088*		
	M31	-10.900*		
	M32	-12.334*		
Overall Project Guidance Self-Efficacy Scale (EFA)**			.960	.960

*p<.001,** For the reliability results of the scale's CFA, see the results and discussion sections.

The items of the 19-item scale are included in Appendix. It was further observed that the difference in item score averages between the upper and lower 27% groups was significant (p <.001). Considering these values, it is possible to conclude that the reliability of the items of the scale is high.

Project Guidance Self-Efficacy Scale's total reliability was confirmed with the values Cronbach's Alpha α=.960 and McDonald's Omega ω=.960 (Table 5). This value indicates a high degree of reliability (Can, 2022). Cronbach's Alpha was calculated as α=.900 for the Guidance for Choosing the Project Topic Self-efficacy, α=.941 for Guidance for Project Implementation Self-efficacy and α=.943 for Guidance for Project Reporting Self-efficacy. The stratified alpha of the entire scale is .97. McDonald's Omega values in the sub-dimensions were calculated as ω=.902, ω=.941 and ω=.943, respectively.

3.3. Findings Regarding Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) was applied to confirm the construct validity of the Project Guidance Self-Efficacy Scale. Cronbach's Alpha value of the CFA data set for the overall scale was calculated as α=.953; McDonald's Omega value was calculated as ω=.952. Cronbach's

Alpha and McDonald's Omega values for the three factors were α=.90 and ω=.90 for Guidance for Choosing the Project Topic Self-efficacy, α=.94 and ω=.94 for Guidance for Project Implementation Self-efficacy and α=.94, ω=.94 for Guidance for Project Reporting Self-efficacy.

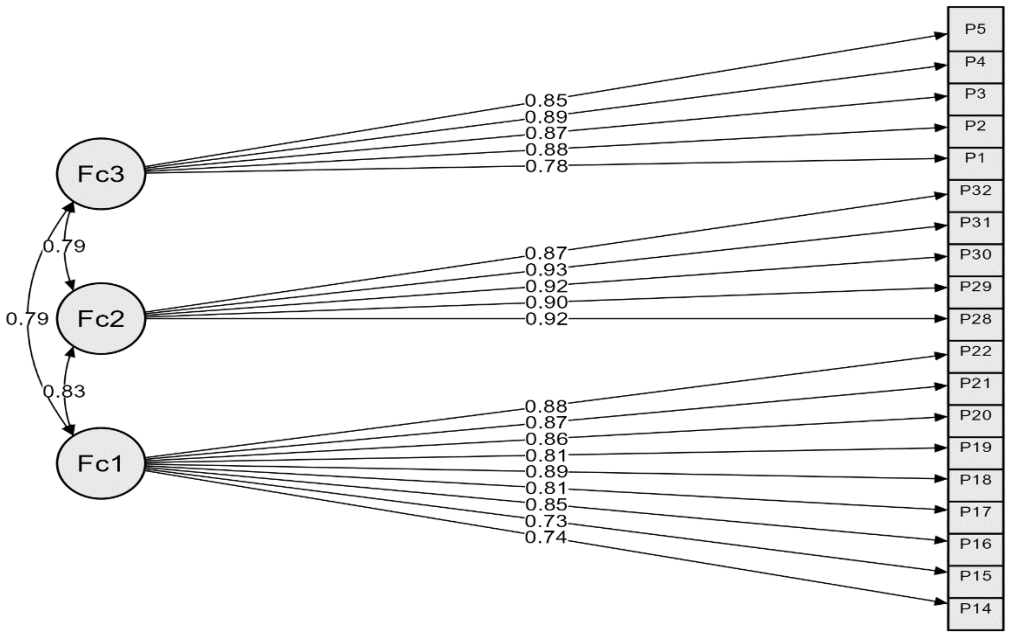
Then, the Chi-Square Fit Test was performed to demonstrate the adequacy of the model tested in CFA and it was reported that values less than 2 for χ^2/df indicate perfect fit and values between 2 and 3 indicate acceptable fit (Schumacker & Lomax, 1996; Schermelleh-Engel *et al*., 2003). Fit indices calculated with CFA were obtained as RMSEA=.049, CFI=.99. The 90% confidence intervals for the RMSEA of the scale were reported as .041 and .058. Ideally, the lower value of the 90% confidence interval includes or is very close to zero (Demir, 2022). It was observed that the statistics of χ^2=285.82 (df=149) were significant (p<.01) and χ^2/df =1.91. The fit indices obtained by applying CFA are presented in Table 6.

Table 6. *Fit indices derived by applying CFA.*

Analysed Fit Indices	Perfect Fit Criteria	Acceptable Compliance Criteria	Derived Fit Indices	Results
χ^2/df	$0 \leq \chi^2/df \leq 2$	$2 \leq \chi^2/df \leq 3$	1.91	Perfect Fit
CFI	.95 ≤CFI≤ 1.00	.90 ≤CFI≤ .95	.99	Perfect Fit
NFI	.95 ≤ NFI ≤ 1.00	90 ≤ NFI ≤ .95	.99	Perfect Fit
NNFI	.95 ≤ NNFI ≤ 1.00	.90 ≤ NNFI ≤ .95	.99	Perfect Fit
IFI	.95 ≤ IFI ≤ 1.00	.90 ≤ IFI ≤ .95	.99	Perfect Fit
RMSEA	.00 ≤ RMSEA ≤ .05	.05 ≤ RMSEA ≤.08	.04	Perfect Fit
SRMR	.00 ≤ SRMR ≤ .05	.05 ≤ SRMR ≤ .10	.03	Perfect Fit
PNFI	.95 ≤ PNFI ≤ 1.00	.50 ≤ PNFI ≤ .95	.86	Acceptable Fit

Comparative Fit Index (CFI), Standardized Root Mean Square Residual (SRMR), Normed Fit Index (NFI), Non-normed Fit Index (NNFI), Incremental Fit Index (IFI) values of the model were observed to be at the perfect fit level (CFI=.99; SRMR=.03; NFI=.98; NNFI=.98; IFI=.99); Absolute Fit Index (RMSEA) and Parsimonious Normed-Fit Indices (PNFI) values were found to be within acceptable values (RMSEA=.04; PNFI=.86). The fit index values derived as a result of the analysis revealed that the model had a good fit. Figure 1 shows the DFA results (Parameter Estimates-Standardized) for the Project Guid-ance Self-Efficacy Scale.

Figure 1. *Model plot (parameter estimates-standardized).*



4. DISCUSSION and CONCLUSION

The main purpose of this study was to examine teachers' project guidance self-efficacy levels and to develop a valid and reliable scale that measures teachers' project guidance self-efficacy. In this context, the Project Guidance Self-Efficacy Scale (PGSS) developed by the authors of the study was administered to teachers from different disciplines. The results of the analysis indicate that the psychometric properties of the constructed scale are acceptable and that it can be used to determine the project guidance characteristics of teachers from all disciplines.

It was found that two scales were developed in the literature to measure project guidance self-efficacy (Mutlu & Yıldız-Fidan, 2018; Yaşar & Oral, 2024). The scale developed by Mutlu and Yıldız-Fidan (2018) was applied to a limited number of teachers in a limited number of disciplines. Although the scale developed by Yaşar and Oral (2024) was applied to a sufficient number of teachers from many different disciplines, the data were obtained from a limited number of provinces. In the scale development process, we tried to ensure the generalizability of the scale by reaching teachers from different regions, provinces, branches, professional experience levels and school types (public, private, rural, urban).

When the psychometric properties of the existing scales in the literature were examined, it was determined that the scale developed by Yaşar and Oral (2024) showed sufficient psychometric values. However, it is noteworthy that the scale items do not reflect the self-efficacy structure to overcome a difficulty or challenge. This situation weakens the construct validity of the scale. In the scale developed by Mutlu and Yıldız-Fidan (2018), it was determined that many sub-dimensions related to project guidance were found together and addressed with a limited number of items. In addition, only exploratory factor analysis was conducted to determine the construct validity of the scale. This situation indicates that the scale has weak psychometric properties. Due to these problems in the developed scales, it was thought that it would be more appropriate to evaluate the project guidance self-efficacy potential holistically. For this purpose, it was decided to develop a valid and reliable project guidance self-efficacy scale. Our project guidance self-efficacy scale is based on the preparation, implementation and finalization of a project.

In the study, there were 5 items under the Guidance on Choosing the Project Topic Self-Efficacy factor (Items 1-5.), 9 items under the Guidance on Project Implementation Self-Efficacy factor (Items 6-14.) and 5 items under the Guidance on Project Reporting Self-Efficacy factor (Items 15-19). In the literature, there are two studies addressing project guidance self-efficacy in different factors (Mutlu & Yıldız-Fidan, 2018; Yaşar & Oral, 2024). When these studies are examined, it is seen that in the scale developed by Mutlu and Yıldız-Fidan (2018), self-efficacy consists of five factors: “dominance of the project process, guidance”, “planning, preparation and reflection”, “implementation and evaluation”, “giving feedback, alternative evaluation” and “group process and high-level learning”. In the scale developed by Yaşar and Oral (2024), it is seen that self-efficacy is handled in four factors “implementation process”, “supervisor self-efficacy, ‘guidance’ and ‘ethics and responsibility’. In these studies, there is no scale that combines the factors of project topic selection guidance, project implementation guidance and project reporting guidance. However, there is a parallelism between the dimensions of “implementation and evaluation” and “implementation process” in the scales developed by Mutlu and Yıldız-Fidan (2018) and Yaşar and Oral (2024) and the dimensions obtained in this study.

In conclusion, the constructed Project Guidance Self-Efficacy Scale has a total of 19 items and 3 factors, and the scores that can be obtained from the scale vary between 19 and 95. The total variance explained as a result of the scale was calculated as 69.208%. Higher scores obtained in the Project Guidance Self-Efficacy Scale indicate that the teacher has a firm belief in successfully performing the behaviors related to guiding a project. There were no reverse-coded items in the scale. Participants indicate how much they agree or disagree with the items included

in the Project Guidance Self-Efficacy Scale by selecting the answers between "Strongly Agree (5), Agree (4), Neither Agree nor Disagree (3), Disagree (2), Strongly Disagree (1)". Cronbach's Alpha and McDonald's Omega reliability values calculated with the CFA data set of the Project Guidance Self-Efficacy Scale indicated perfect internal consistency (Overall PGSS α=.95, ω=.95; Guidance for Choosing the Project Topic Self-efficacy α=.90, ω=.90; Guidance for Project Implementation Self-efficacy α=.94, ω=.94; Guidance for Project Reporting Self-efficacy α=.94, ω=.94) (Özdamar, 2002; George & Mallery, 2003). These values mean that we can keep each dimension of the scale separate.

The results of the study further indicated that the psychometric properties and reliability of the developed Project Guidance Self-Efficacy Scale were appropriate to measure the teachers' level of self-efficacy belief that they can perform behaviors related to guiding students' projects. PGSS is concerned with the individual's belief in successfully engaging in behaviors related to getting a project done. In this respect, it is compatible with Bandura's (1977) definition of self-efficacy belief in being able to do certain tasks.

5. SUGGESTIONS

5.1. Implications for Education and Teaching

The results of the study suggest that the Project Guidance Self-Efficacy Scale may help to measure the self-efficacy levels of teachers from disciplines such as science, social, arts etc. with regard to their ability to lead and guide their students in their projects and to develop further practices to improve the teachers' competencies in this regard. As it was concluded in this study that teachers can successfully guide their students in their projects, these experiences can be reflected more frequently in the learning-teaching environment to improve project guidance experiences with students. PGSS, which will be used in detailed studies on teachers, can help in the design of new project-based learning-teaching studies. With the help of this scale, further detailed studies examining the level and sources of project guidance self-efficacy beliefs of wider groups of teachers can be supported. Thus, by using the PGSS constructed herein, further research may be conducted to improve the quality of teachers' project guidance at schools, a higher level of benefit may be gained from project-based learning, which is one of the most important learning approaches that serve student skills and learning to contribute to the development of the 21st-century education system in Türkiye/Turkish-speaking countries.

5.2. Limitation

This study has the following limitations:

- Teachers working in different countries, regions or education systems may have different experiences. This may limit the applicability of the scale.
- Teachers' socio-economic or cultural backgrounds may cause them to respond differently to the scale items.
- Some dimensions or items may differ according to teachers' experience and branches.
- It may not be applied in the same way to teachers from different branches and experience levels (more or less project experience).
- Different reasons (heavy workload, length of the scale, fatigue, etc.) may cause teachers to leave the scale without completing it or to respond quickly and carelessly.
- Teachers may be concerned about the confidentiality of their responses and may not give honest answers.

Declaration of Conflicting Interests and Ethics

The authors declare no conflict of interest. This research study complies with research publishing ethics. The scientific and legal responsibility for manuscripts published in IJATE belongs to the authors. **Ethics Committee Number**: Aksaray University, 2022/04-53.

Contribution of Authors

Perihan Güneş: Conception, Design, Investigation, Literature review, Methodology, Data collection, Data interpretation, and Writing-original draft. **Esra Çakırlar Altuntaş**: Methodology, Formal analysis, Finding. **Miraç Yılmaz:** Conception, Design, Supervision, Critical review, and Writing-original draft.

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APPENDIX

Appendix 1. *Items included in the Project Guidance Self-Efficacy Scale.*

1. I can enable students to express salient modern-day problems awaiting solutions.
2. I can enable students to conduct literature research to choose project topics regarding salient problems
3. I can support students in developing creative project ideas to solve modern-day problems.
4. I can enable students to construct a project goal for solving problems, even if they have not done any projects before.
5. I can guide students to develop a research hypothesis suitable for the project's goal.
6. Even if my experience in project guidance is limited, I can support to work collaboratively of the project team.
7. I believe I can support my students to reach out to field experts for help.
8. I can enable my students to be in good communication with teachers, friends and others during the project process.
9. I can ensure everyone in the project team to fulfil their responsibilities.
10. I can ensure students in conducting their experiments/fieldworks in the implementation phase according to plan.
11. I can assist students to correctly use laboratory/field tools and equipment.
12. I believe I can guide students to manage any problem that may emerge during implementation.
13. I can enable my students to appropriately conduct their experiments/fieldworks during implementation.
14. I believe I can guide them to use time efficiently, in accordance with the project plan.
15. I believe I can support my students to interpret project results, bringing in their own commentary.
16. I can support students to make appropriate pertinent inferences regarding the obtained results.
17. I can to oversee my students as they defend their inferences using proof from the literature.
18. I can support them in explaining their results with suitable reasoning.
19. I am able to guide the writing of project results in accordance with scientific methodology (objective, methodology, findings, discussion).